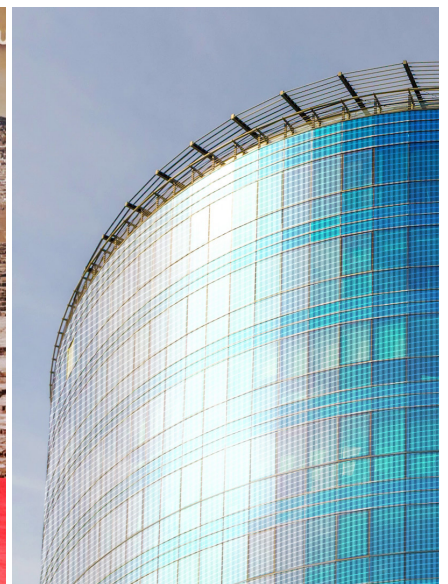
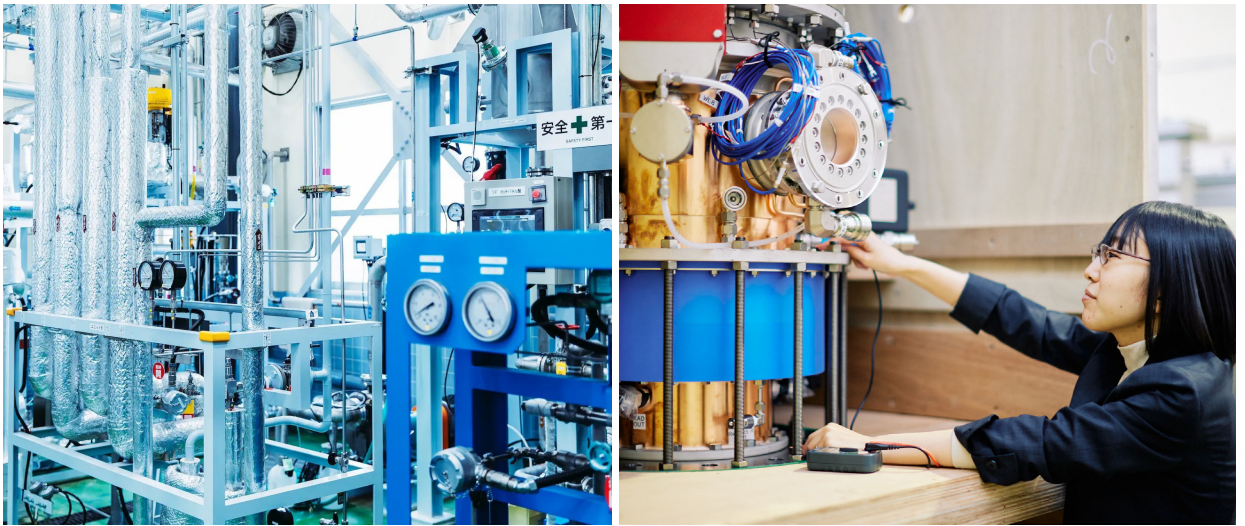


KIZUNA

Autumn
2023

Linking Japan and the World



New Technologies
for a Sustainable Future



JAPAN GOV
THE GOVERNMENT OF JAPAN



Welcome to KIZUNA, the official magazine of the Government of Japan.

This bold work of calligraphy is 絆 (*kizuna*) written in Japanese. *Kizuna* means the enduring bonds between people—close relationships forged through mutual trust and support.

Originally describing the rope used to tether domestic animals such as horses and dogs, the meaning of *kizuna* has evolved over the years. A passage in *The Tale of the Heike*, compiled in the 13th century, uses the term to refer to the bonds of love between a father and his children. More recently, *kizuna* has gone beyond bonds tying together family and close acquaintances; it is now used in a broader sense of human ties and connections. Of particular note is the *kizuna* born among people during natural calamities, which fosters feelings of solidarity and serves as the underlying strength to overcome hardships.

Similarly, the *kizuna* cultivated among the countries of the world has the power to deepen cooperation for a better future. By reporting on a wide variety of topics concerning Japan, we hope that this magazine will provide opportunities for Japan and the rest of the world to connect and build strong *kizuna*.



KANAZAWA SHOKO
Calligraphy Artist

Born in Tokyo in 1985, she started learning calligraphy from her mother when she was five years old. One of the notable young calligraphers of today, her solo exhibitions have been held throughout the world, in cities such as New York, Singapore, and Prague. She was selected as one of the official poster artists for Tokyo 2020.

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KIZUNA

Autumn 2023

COVER

(Clockwise from top left)
The pilot plant of Tsubame BHB,
which develops small-scale ammonia
production systems; the laboratory of
Kyoto Fusionering, which develops
engineering technologies for
commercial fusion reactors; image of a
perovskite solar cell wall installation*;
Prime Minister KISHIDA Fumio and
Mrs. KISHIDA Yuko at the G20 New
Delhi Summit, with Prime Minister of
India Narendra Modi (left) and
Hon'ble President Smt. Droupadi
Murmu (second from the right).**

Photo credit: *NEW ENERGY AND INDUSTRIAL
TECHNOLOGY DEVELOPMENT ORGANIZATION;
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JAPAN'S LONG-PLANNED PHOTOVOLTAICS: SPACE-BASED SOLAR POWER AND PEROVSKITE SOLAR CELLS

Solutions are emerging to conquer solar power's shortcomings, namely, limited installation sites and low-capacity utilization rates. Japan is spearheading the development of two promising technologies to make optimal use of both the Earth and space and fully harness the Sun's power as electricity: space-based solar power and next-generation flexible solar cells.

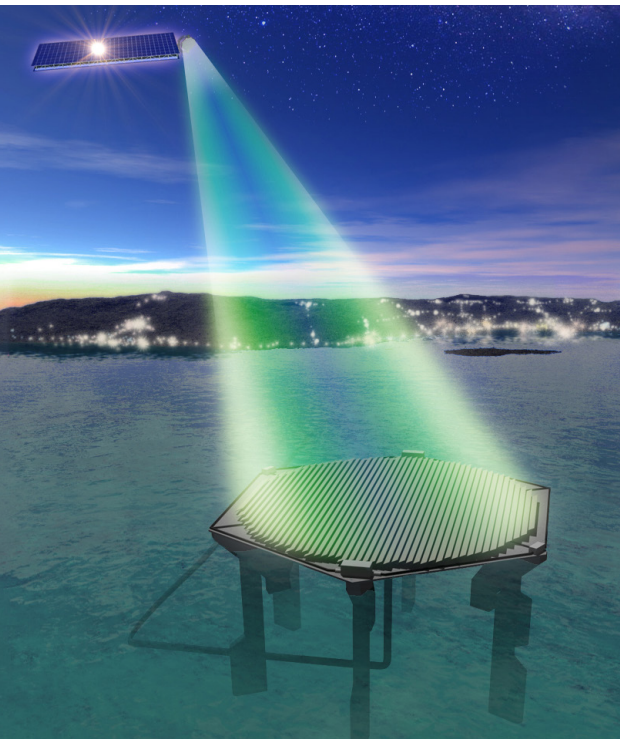
Sunlight illuminates and warms the Earth and is the ultimate source of all biological activity. Solar power, which converts the Sun's energy into electricity, is one method of generating power

that the world is increasingly focusing on in the effort to create a decarbonized society.

Although solar power has been in practical use since the 1970s, it has yet to become a major source of

power worldwide. That stems from the dearth of appropriate locations for installing solar panels, along with the low-capacity utilization rate as power generation falls off, such as at night, during bad

Left: Diagram of a space-based solar power (SBSP). An antenna located at sea receives microwaves transmitted from a satellite in geostationary orbit and converts them into electricity. Microwave irradiation requires an accuracy of less than 0.001° in angular error. SHINOHARA LAB., KYOTO UNIV.
Right: Image of a perovskite solar cell (PSC) wall installation. NEW ENERGY AND INDUSTRIAL TECHNOLOGY DEVELOPMENT ORGANIZATION





Professor SHINOHARA Naoki of Kyoto University's Research Institute for Sustainable Humanosphere specializes in wireless power transmission, space solar power stations, and microwave processing. He has served as a member of the Japan National Space Policy Committee and as chair of the Wireless Power Transfer Consortium for Practical Applications. SHINOHARA LAB., KYOTO UNIV.

weather, or when the panels get dirty.

To maximize the use of solar energy and overcome those drawbacks, two promising technologies have been developed: space-based solar power (SBSP) and next-generation flexible solar cells. Japan is making steady progress toward the practical implementation of both.

The SBSP project involves the space launch of satellites equipped with giant solar panels measuring 2 km², converting the generated electricity into microwaves that are then transmitted wirelessly to the ground. Since the satellites will be able to generate power day or night regardless of the weather, they will boast a high-capacity utilization rate of at least 90%, generating an estimated five to 10 times more power than ground-based solar panels, whose capacity utilization rate is a mere 15% or so. Each satellite will generate 1 million kW of electricity, equivalent to the output of a nuclear power plant.

Microwaves—a type of electromagnetic wave, used now daily in microwave ovens and

communications equipment, that the system will use to transmit the power to the ground—can penetrate clouds and rain if the optimum frequency is selected, making them virtually free from weather interference. Since the transmission would be wireless, moreover, the target destination can be changed as needed. The SBSP concept was first proposed in the U.S. back in 1968, but research has stalled due to several technical and cost-related issues, such as the difficulty in establishing highly efficient systems for power generation and transmission and the transport and assembly of giant solar panels. With recent technological advances, however, SBSP technology has begun to garner renewed attention around the world.

Meanwhile, Japan has been continuing SBSP research for several decades through industry-academia-government collaboration. Kyoto University has already taken the lead in establishing wireless power transmission technology using microwaves, a fundamental element of SBSP. In 1990, the university's Professor SHINOHARA Naoki was inspired to enter the field by his mentor at the time, Professor MATSUMOTO Hiroshi, who said, "SBSP is a technology that will enable the human race to survive for the next 10,000 years." Looking back on his old mentor's declaration, Shinohara said, "If the Earth's population continues to grow, so will the amount of electricity consumed, and the generation capacity on the ground

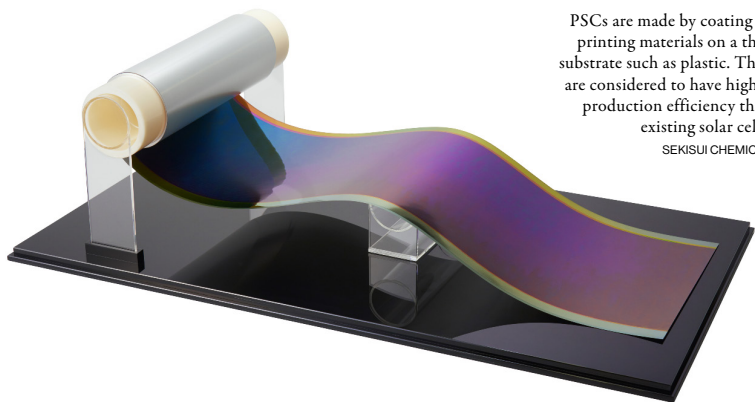
will be insufficient to supply the necessary power. That's why we need to go into space."

Since the 1980s, Japan has conducted many SBSP experiments in outer space and accumulated a large amount of relevant data, even when research has been suspended elsewhere. In 1983, it conducted the Microwave Ionosphere Nonlinear Interaction eXperiment (MINIX), which transmitted power from one rocket



The photo shows a microwave wireless power-transfer experiment from an airship to the ground, conducted by Kyoto University in 2009. Due to its ability to send and receive power over longer distances than other contactless power-transfer methods, the technology to wirelessly transmit power with microwaves shows promise for use in a variety of applications on the ground, such as supplying power to disaster areas where infrastructure has been disrupted.

SHINOHARA LAB., KYOTO UNIV.



PSCs are made by coating or printing materials on a thin substrate such as plastic. They are considered to have higher production efficiency than existing solar cells.

SEKISUI CHEMICAL

to another in space plasma for the first time in world history. Later, in 1993, the country conducted a successful rocket experiment using the then newly developed phased array antenna for more accurate power transmission in space plasma. Japan also has strong enough capabilities in satellite system design to maximize power generation efficiency and accurately transmit power to the ground.

Shinohara said, “SBSP has been incorporated into the Japanese government’s Basic Plan on Space Policy since it was first formulated in 2009. I’ve been researching SBSP technology for many years, and now that there is global attention on it, I feel it will truly work out.” The current plan has set a goal of conducting a space-to-ground power transmission experiment by fiscal 2025. The California Institute of Technology already successfully conducted such an experiment earlier this year, but Japan is aiming to transmit power with even greater precision, with the focus on developing beam-control technology to accurately send microwaves from

a fast-moving satellite in low orbit to a receiving antenna on the ground. Progress is steadily being made toward the goal of creating a feasible SBSP around the middle of the century.

On the other hand, the social implementation of “flexible solar cells,” namely perovskite solar cells (PSCs)—a technology that will expand the area available for generating solar power on the Earth—is currently being demonstrated. Utilizing the Green Innovation Fund established by the Japanese government, several companies and research institutes are working together to develop practical applications and popularize PSCs.

PSCs were invented in Japan, with the first research paper published in 2009. PSCs are film-shaped solar cells made of a material whose crystal structure resembles that of a mineral called perovskite. The cells are thin, lightweight, and flexible, in contrast to today’s mainstream silicon solar panels, which are thick and rigid, and thus face restrictions on where they can be installed. Meanwhile,

the power-generating layer of a PSC is less than 1 μ m thick, more than 100 times thinner than a traditional silicon solar cell. PSCs, which are about one-tenth the weight of ordinary solar cells, can thus be installed in places where conventional solar panels cannot, such as on the exterior walls of a building or on curved surfaces.

One company currently developing PSCs is SEKISUI CHEMICAL CO., LTD., a major chemical manufacturer. One problem with PSCs is their poor durability; outdoors, they quickly degrade owing to moisture, oxygen, and ultraviolet light. This is where SEKISUI CHEMICAL’s technological expertise comes into play. MORITA Takeharu, Director of the Perovskite Solar Cell Group at the company’s R&D Center, said, “Our strengths lie in our sealing technology that protects precision equipment from dust and moisture, as well as our film sheet manufacturing. We have the largest global share of liquid crystal sealants, as well as interlayer



MORITA Takeharu (right), Director of SEKISUI CHEMICAL’s R&D Center Perovskite Solar Cell Group, is shown holding a PSC along with KOGA Meiko (left), Executive Officer of the company’s Corporate Communications Department. SEKISUI CHEMICAL

films for automotive laminated glass. We are also working with customers and suppliers to develop construction and installation techniques. Our development now is geared toward future maintenance and replacements.”

With more than 30 companies and local governments collaborating, many demonstration tests and joint-research projects are underway. In April 2024, a major IT company in Tokyo plans to install PSCs on the walls of a data center for a demonstration test. In order to control their indoor temperature and prevent intrusion, data centers normally have few windows, which makes a substantial portion of their wall surfaces suitable for installing PSCs. Data centers also consume a lot of power because they operate many servers, so decarbonization is an important issue. After the conclusion of the demonstration tests, the IT company intends to install PSCs at 16 of its data centers across Japan.

Other pilot projects are in the planning and implementation stages at sewage treatment plants, thermal power plants, railroad facilities, public facilities, and elsewhere to investigate durability and power-generation efficiency under various conditions. After the trials are completed, the PSCs will be deployed to other similar facilities nationwide. KOGA Meiko, Corporate Communication Department Head and Executive Officer at SEKISUI CHEMICAL, said, “For over 75 years, we have been working to solve environmental issues through

our businesses and products, but perovskite solar cells seem to hold particularly great promise. Through this technology, we hope to contribute to the building of social infrastructure that helps give people around the world peace of mind.”

This April, at the Ministerial Council on Renewable Energy, Hydrogen and Related Issues, Prime Minister Kishida announced that Japan aims to introduce PSCs to society as soon as possible, instead of waiting until 2030. Commenting on that announcement, Morita said, “It is beyond anything I ever expected that our company and our country would be pursuing the same goal,” but added, “We have to make a nationwide effort to develop feasible PSCs as quickly as possible and spread them across the globe.”

The search for more sustainable and efficient methods of power generation is indispensable for humanity’s survival over the next 10,000 years and beyond. Moreover, given the unstable state of global



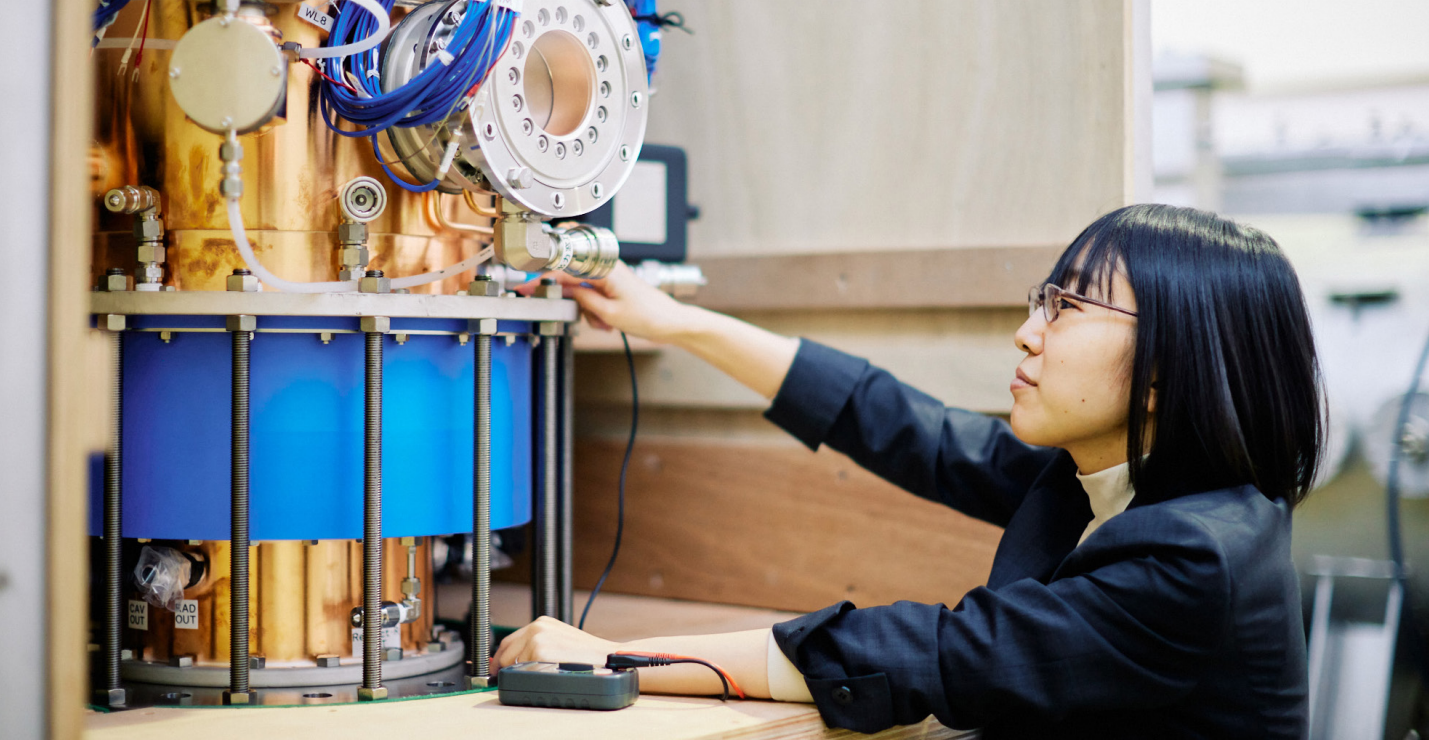
In May 2023, a PSC test measuring the power-generation efficiency of PSCs and verifying their corrosion resistance performance began at the Morigasaki Water Reclamation Center, a sewage treatment facility in Tokyo and the largest water reclamation facility in Japan. Tokyo Governor KOIKE Yuriko (foreground, left) and SEKISUI CHEMICAL President and Representative Director KATO Keita (foreground, right), who is a co-researcher, mount a PSC to a pipe.

TOKYO METROPOLITAN GOVERNMENT

affairs, energy security has become an urgent issue for every country. It will become increasingly important to introduce renewable energy sources that do not require fuel, and to diversify energy sources. Japan’s efforts to harness the potential of solar power, a well-known renewable energy source, will shine a light on humanity’s future. ●



PSCs produced by SEKISUI CHEMICAL, which were also exhibited at the International Media Center (IMC) at the G7 Hiroshima Summit. SEKISUI CHEMICAL



INEXHAUSTIBLE ENERGY: ENGINEERING TO REALIZE FUSION POWER

There are grand expectations for fusion power around the world in the pursuit of energy security and decarbonization. Kyoto Fusioneering Ltd. is a unique Japanese startup specializing in fusion plant engineering. What are the company's latest efforts?

“Recreating the Sun on Earth” is how fusion power generation attempts are often described. Born almost 5 billion years ago, the Sun shines thanks to the process of fusion. In this case, hydrogen, which has a light atomic nucleus consisting of one proton in its most common form (known as protium), combines with other hydrogen atoms to form helium, which has a heavier nucleus with two protons and two neutrons. Fusion power seeks to replicate that phenomenon on the ground as a next-generation energy source.

The most viable method of producing fusion energy on Earth is to fuse together deuterium and

tritium, two different isotopes of hydrogen. The energy obtained by fusing just one teaspoon of fuel is roughly equivalent to that of a tanker truck full of petroleum (about 8 tons). Fortunately, gases such as carbon dioxide and nitrogen oxides are not produced in the fusion process. Unlike conventional nuclear power, which involves chain reactions of nuclear fission, nuclear fusion is easier to control as no such chain reactions take place. Moreover, because the primary fuels—deuterium and lithium—for fusion power exist in abundance in seawater and elsewhere, humanity will have a near-permanent source of energy if

fusion becomes practical.

“It is difficult to generate fusion energy in a stable way, and even if we succeed in producing it, we may not necessarily be able to harness its energy. We also need to develop such peripheral technologies as fuel handling and heat recovery. Ours is the only company in the world working in that field,” said NISHIMURA Miki, Doctor of Philosophy and Business Development Manager at Kyoto Fusioneering Ltd.

The company, which is a spin-off from Kyoto University, supports research institutes and private companies around the world that are engaged in fusion R&D.

Its technological capabilities are based upon the knowledge of KONISHI Satoshi, Professor Emeritus at Kyoto University. Konishi, a leading expert in fusion plant engineering and a founding member of the company, has been involved with International Thermonuclear Experimental Reactor (ITER), a global fusion megaproject launched in 1985.

YOGO Megumi is Corporate Design Division Manager at Kyoto Fusionering. “There are many technological challenges: with materials, for example, one has to improve a component’s heat and corrosion resistance. Our business model is proposing customized solutions to clients to address such issues,” said Yogo. “Even the tiniest error of just a few microns is not permitted in any component or aspect of engineering in a fusion plant. In this respect, Japanese companies, which excel at precise manufacturing, are well suited to this kind of work. As a global Japan-based company, we want

to serve as a bridge between outstanding domestic companies and the rest of the world.”

The company is also currently constructing an integrated testing facility for fusion power plant components, named the UNique Integrated Testing facility (UNITY), where a world-first demonstration test is slated for the end of 2024. The test will comprehensively assess an integrated series of components used for extracting heat from a fusion core to generate power, under conditions close to those of a commercial fusion power plant. If successful, it will demonstrate, for the first time, the possibility of generating power through nuclear fusion, taking a major step toward the goal of viable fusion energy.

“In addition to the ITER project, fusion research in the private sector has become more active in recent years, primarily at U.S. startups. The companies in the fusion industry are more like partners aiming for the same goal, rather than rivals. We would like to contribute in some way to the realization of fusion power,



A gyrotron, a special machine that heats the plasma fuel with microwaves to 100 million degrees Celsius or higher. It operates in a similar way to an extremely powerful microwave oven.

based on the solid foundation and capabilities of Japan’s manufacturing industry,” said Nishimura.

“The best thing about fusion energy is that it is a form of energy that can be produced anywhere in the world. This technology has the potential to close the global divide caused by the uneven distribution of natural resources,” added Yogo.

Looking to the future, Kyoto Fusionering plans to use the enormous thermal energy generated by fusion plants not only for electricity production but also for carbon fixation. There is no shortage of ideas for the technology, from miniaturizing fusion reactors and mounting them on rockets to generating electricity at sea.

When fusion technology is perfected and the “Sun is recreated on Earth,” humanity will see the dawning of a new era. ●



Left: NISHIMURA Miki (left) and YOGO Megumi (right) from Kyoto Fusionering. “Fusion energy sits at the forefront of human knowledge. At this moment in time, we are standing on the shoulders of giants. In other words, the knowledge and technology that humans have developed so far have opened up new horizons,” affirmed Nishimura.

Right: A graphic image of the UNique Integrated Testing facility (UNITY), slated for completion in 2024. A high-temperature, high-magnetic field environment, mimicking that of a fusion core (blanket), will be simulated without the use of radioactive tritium fuel to demonstrate a series of power generation systems.



JAPAN'S INNOVATIVE CATALYST ENABLES LOCAL PRODUCTION OF AMMONIA

Ammonia has wide-ranging applications, such as fertilizer or other chemical products, and has been garnering attention in recent years as a zero-emission fuel. Tsubame BHB has developed a small-scale plant that can synthesize ammonia at low temperatures, low pressure, and low cost. What innovations is the company eyeing for the future?

As ammonia contains the nitrogen necessary for crops to grow, it is widely used as a raw material for fertilizers as well as for other chemical products. Also, since it does not emit CO₂ during

combustion, the material has been attracting attention in recent years as a next-generation fuel for decarbonization.

The production of ammonia requires a high-temperature, high-

pressure environment to induce a reaction between nitrogen and hydrogen. That is why mass and centralized production at large plants has been the norm. Developing countries that cannot afford such large-scale facilities are forced to bear the high cost of transportation and storage.

If the reaction between nitrogen and hydrogen were to be achieved at low temperatures and pressure, however, the resulting downsizing of facilities could enable the production of ammonia locally—in developing countries and elsewhere—in exactly the quantities needed. Tsubame BHB Co., Ltd., a startup spun out of the Tokyo Institute of Technology, has garnered prominence for its new catalyst technology that realizes such a goal. Its innovative electrified catalyst—an article about which was published in



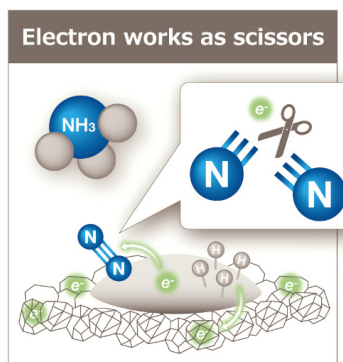
Top: Ajinomoto Co., Inc., a Japanese food company and Tsubame BHB shareholder, made its factory in Kawasaki City available for the installation of the startup's pilot plant. In operation since 2019, the plant produces 20 tons of ammonia a year at a steady pace.

Right: In conjunction with the Ukraine Recovery Conference held in London, Japan's Ministry of Economy, Trade and Industry, the Ministry of Foreign Affairs, and the Japan External Trade Organization co-hosted the Japan-Ukraine Public-Private Roundtable, at which a memorandum of understanding (MOU) was signed for the Green Industrial Zone Project in Bucha, Ukraine. The event, attended by around 120 participants from Japanese and Ukrainian industries, confirmed the promotion of partnerships between the public and private sectors as well as between companies from both countries.



the Nature Chemistry journal in 2012, submitted by HOSONO Hideo, a professor emeritus at the university—facilitates the cleavage of the strong bonds within nitrogen molecules, thereby paving the way for synthesizing ammonia at low temperatures and pressure.

Hosono's research was grounded in his desire to create technologies "essential for life." Tsubame BHB, founded in 2017, inherited that concept and embraced the mission of using creative technologies to solve human issues related to the environment and food. According to Tsubame BHB Representative Director & CEO NAKAMURA Koji, "In order to eliminate the world's food imbalance, what's crucial is to develop small devices that can easily make the required amount of ammonia on site." The company's pilot plant, which can produce 20 tons of ammonia a year, has proven that the catalyst is stable, enabling the company to move faster toward



In an electrified catalyst, electrons act as anions and behave like scissors to separate tightly bound nitrogen molecules at low temperatures and pressure.

Tsubame BHB Representative Director & CEO NAKAMURA Koji (right) and marketer SUDA Hiromi (left). Its first commercial small-scale ammonia synthesis facility for a demonstration test of hydrogen and ammonia production in Kashiwazaki City will begin operation in August 2025. "With global interest in ammonia growing, it is critical to stay ahead of the curve, so we are determined to make a strong case for commercialization," says Nakamura.



commercialization.

Small-scale, on-site production would also facilitate the production of green ammonia from hydrogen produced by renewable energy sources. For example, in Laos—which has abundant hydropower—Tsubame BHB has been involved in a project to investigate the profitability of locally produced green ammonia from surplus hydropower for local consumption with the cooperation of the country's Ministry of Energy and Mines. "The Lao government is committed to agricultural development to help Laos graduate from its position as a least developed country. We would be happy if our technology could contribute to both productivity gains and decarbonization," said SUDA Hiromi, who is in charge of the company's marketing and business development in developing countries.

In May of this year, Tsubame BHB announced its involvement in the Green Industrial Zone Project in Bucha, Ukraine, which

aims to make hydrogen and ammonia from renewable energy for use in electricity generation and fertilizer production. The startup is partnering with the Polish hydrogen system designer Hynfra and the Ukrainian engineering firm UTEM. Tsubame BHB will provide its ammonia-synthesis technology to help Ukraine achieve its twin goals of reconstructing after Russia's aggression and achieving energy independence.

The current global output of ammonia is insufficient for it to be used extensively as fuel, so it is necessary to expand production at a low cost. Nakamura says, "We will focus on minimizing the size of our facilities for on-site production in developing countries, while at the same time focusing on developing highly efficient catalysts that can be applied to large-scale ammonia plants, with an eye to fuel applications." Tsubame BHB will continue exploring solutions to this issue affecting all of humanity. ●

DELICIOUS SEA URCHINS

RESTORE OCEANS AND HELP DECARBONIZATION

The disappearance of kelp forests in the oceans causes great damage to marine ecosystems and is becoming an increasingly serious threat around the world. One Japanese startup company tackling that problem is drawing international attention not only because of its efforts to restore oceans into vibrant ecosystems, but also for its value-creating business model.

Sometimes called “nurseries of the sea,” kelp forests sustain a whole host of aquatic life. These rich seaweed forests have in recent years attracted attention as blue carbon ecosystems for their ability to capture and sequester carbon dioxide from seawater. However, barren seafloors, devoid of such fertile feeding and breeding grounds, have become a grave threat for oceans worldwide. One cause of that problem is sea urchins, *uni*, which, because of rising seawater temperatures from global warming and other factors, have been able to reproduce unhindered, leading to overgrazing on the kelp forests. Sea urchins are

in increasing demand worldwide as a high-end ingredient in Japanese cuisine such as sushi, but those sea urchins that have overgrazed kelp forests down to the barren seafloor essentially starve and become empty. Since there is nothing to eat inside them, they have no commercial value and were previously simply discarded.

While many people involved in the fishing industry have been left scratching their heads, the circular business model of the Japan-based startup Urchinomics is a ray of hope to solve that problem. Urchinomics engages with fishers to procure empty



“When you look at sea urchins every day, you can tell whether they are feeling good or bad. I think that sea urchins are more straightforward than people,” says ARAI Miho, whose knowledge gained through many years of work on wastewater treatment is now devoted to sea urchins.



Top: “Zombie” urchin—empty sea urchins are almost devoid of anything edible.

Bottom: Sea urchins farmed at the Kayoi Uni Base just before being shipped. These sea urchins are filled with plump roe and shipped as premium seafood.

sea urchins, cultivate them through ranching on a short-term basis, and ship them to restaurants and sushi chains throughout the year as valuable marine products.

A catalyst for that model was the Great East Japan Earthquake of 2011. Along the Tohoku coastline, sea urchins appeared prolifically due to changes in the marine environment caused by the tsunami. The proliferation of sea urchins led to wider desolation on the seabed. Aware of the current plight, a project began with the help of Norwegian technology, which had been used to conduct advanced research in sea urchin farming. Urchinomics was established in 2017, leading to the world’s first sea urchin farm being set up in Oita Prefecture in 2021. Initiatives such as that—namely, those that treat environmental issues as a business and which can help create jobs for the local community—are increasingly in the spotlight.

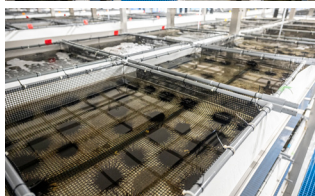
Urchinomics’ second facility in Japan, Kayoi Uni Base, was created in 2022 in Yamaguchi Prefecture. Built in collaboration with a local seafood processing company, the huge farm has an annual production capacity of 34 tons, making it the largest sea urchin ranch in the world. At the heart of the sea urchin farm is a unique compound feed made primarily from the offcuts of *kombu* kelp (harvested sustainably), and an efficient ranching system designed specifically for

breeding sea urchins on land. Coupled with that is expertise in knowing how to reliably ship sea urchins without exposing them to the natural environment during their breeding period of two to three months.

ARAI Miho, a water treatment specialist and plant engineer, says, “There are still many things we don’t know about sea urchins. Focusing solely on levels of water quality will not produce high-quality sea urchins full of roe. It’s a daily process of trial and error. Yet, the quality of the sea urchins we can ship from our farms is the key to our circular business, so I feel a great sense of satisfaction.”

Urchinomics was endorsed for its exemplary innovation in the United Nations Decade of Ocean Science for Sustainable Development in 2022. And through its kelp restoration efforts from 2021 to 2022 to remove empty sea urchins, Urchinomics secured blue carbon credits equivalent to 2.6 tons of sequestered carbon. That had only previously been done with mangroves overseas, but now Japan, blessed by waters on all sides, is the first country in the world to obtain blue carbon credits from kelp forests.

Today, demonstration experiments are underway not only in Japan but also in the United States, Canada, New Zealand and other countries where there is much interest from fisheries. The goal of Urchinomics is to roll out the sea urchin ranching business to all regions that suffer from overgrazed, desolate seafloors, helping to restore the rich and vibrant nurseries of the sea. With passion and technology, the challenge for Urchinomics rolls on. ●



There are about 200 tanks in the ranching facility where water suitable for sea urchins is processed through a closed circulation system called the Recirculating Aquaculture System.



After studying aerospace engineering at the University of Tokyo Graduate School, YAMAZAKI Naoko was certified as Japan's second female astronaut in 2001. Currently a member of subcommittees of the National Space Policy Committee of Japan, she also engages in a wide variety of activities, from giving lectures and writing about space to developing human resources.

MAKING OUR WORLD BETTER FROM SPACE: A JAPANESE ASTRONAUT'S PERSPECTIVE

Amid rapid global advancements in the development and utilization of outer space, Japan is carrying out new efforts in its aim to become a “self-sufficient space-faring nation.” A former Japan Aerospace Exploration Agency (JAXA) astronaut explains the country's future space vision and the possibilities that are opened up through the use of outer space.

Today, over half a century since the first human footsteps were planted on the Moon, space development and utilization are advancing at a feverish pace. In 2022 alone, a record number of satellites and other objects were launched into orbit—2,368 in total, about 11 times that of a decade ago—for various purposes,

from national security and communications to disaster management and environmental conservation. While on the one hand, private firms have begun to offer manned spaceflights, Artemis, an international space exploration program promoted by the United States, aims to send humans back to the Moon as early

as 2025, with the subsequent plan to develop infrastructure for sustainable activities on and around the Moon. “Momentum is building to not just go to space, but to also expand economic activities to cislunar space, the area between the Earth and the Moon's orbit,” says YAMAZAKI Naoko, a former astronaut with the Japan Aerospace Exploration Agency (JAXA), who now serves as a member of subcommittees of the National Space Policy Committee of Japan.

Against that backdrop, Japan is advancing new initiatives to become a “self-sufficient space-faring



In 2010, Yamazaki (top right) boarded the Space Shuttle Discovery and spent 15 days in space, including time on the International Space Station. “When I returned to Earth, I was struck by how much I appreciated breezes and the fragrance of plants. That made me want to take good care of what is usually taken for granted. When people consider the issues facing the planet, I want them to look for solutions by broadening their horizons to space. That will expand both their ideas and possibilities.” NASA

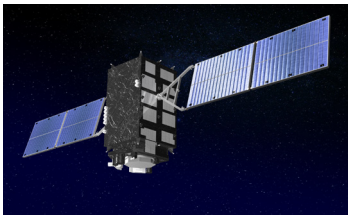
nation.” With its sights set on participation in the Artemis program, JAXA selected two astronaut candidates in February 2023. Then, this June, Japan revised its Basic Plan on Space Policy with the aim of maintaining and strengthening the autonomy of its space activities. “As space becomes an indispensable foundation for national security, industry, and daily life, the ability to nurture and possess its own key technologies for accessing and utilizing space will be crucial for any global leader,” notes Yamazaki.

Recent advancements in space exploration have been driven mainly by the private sector. Some estimates see the global space industry tripling in scale from 350 billion dollars in 2020 to over 1 trillion dollars by 2040. The private sector already launches more satellites every year than does the public sector worldwide, and in Japan innovative businesses have been generated such as startups that aim to remove space debris—an increasingly serious issue of late. Yamazaki points out, “Just as various IT industries first came into existence when the Internet became accessible to everyone,

space can be a place where diverse ideas emerge.”

Crucial to such a future is the reinforcement of infrastructure promoting private-sector activities. One example is the Quasi-Zenith Satellite System, the global navigation satellite system developed by the Japanese government. Working in combination with the Global Positioning System (GPS), it enhances the accuracy of location information to within centimeters of an object’s actual position. Current efforts to fortify the system are sure to significantly broaden its applications, including the operation of autonomous drones, and by the mid-2020s, it is expected to provide such highly accurate information even without the support of GPS.

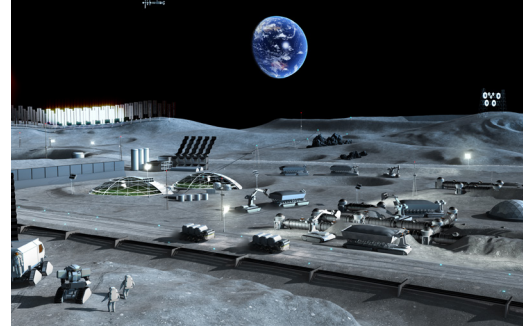
Constructing and organizing satellite-launching sites and space transportation bases will also be important, given the expected increase in demand. Yamazaki herself has been working with local governments, private organizations, and related ministries to create a platform for collaboration among spaceport projects throughout Japan.



Left: Over the next few years, Japan plans to increase the number of satellites in its Quasi-Zenith Satellite System, which provides highly accurate positioning information. That will enable the system to be used widely in the rest of Asia and in Oceania. QZSS.GO.JP



Right: An artist's rendering of a spaceport. Currently, there are regional plans to construct such spaceports in four locations across Japan, from Hokkaido to Okinawa. In the future, such rural areas might serve as space transportation hubs. ©2020 CANARIA, DENTSU, NOIZ, SPACE PORT JAPAN ASSOCIATION.



Artemis—an international space exploration program in which Japan is participating—aims to establish a long-term presence on the Moon's surface and in its general vicinity, with the eventual goal of serving as a relay point for exploratory missions to Mars. JAXA

Projects are already underway in four locations, as is coordination with national spaceport projects, with the ultimate goal of making Japan Asia’s spaceport hub. “Locating such crucial ports here will be vital to making Japan a global leader and will also generate new industries with high added value.”

Yamazaki had dreamed about space and set her sights on becoming an astronaut ever since childhood, but after participating in a mission working on the International Space Station in 2010, she experienced a radical change in her perspective. “When I was up there, I came to the awareness that space was an endless expanse of darkness, and that instead, what was truly irreplaceable was the brilliant blue Earth shining in the midst of that darkness. And it made me feel that my new mission was to protect it. We can use space to change our planet for the better. To do that, though, it is important for us to cooperate with various countries and people under the principles of the Outer Space Treaty—the United Nations space treaty, which states that the exploration and use of outer space shall be the province of all mankind.”

MICROSATELLITES ADDRESSING EARTH'S CHALLENGES FROM SPACE

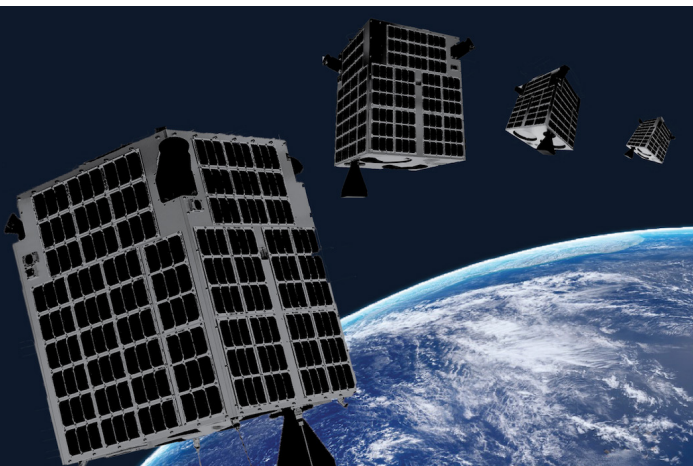
With worldwide efforts accelerating to utilize space, a Japanese startup, Axelspace, has developed microsattellites that can be mass-produced to reap new benefits from space. The company offers an exciting vision for the future of the space industry.

“In the not-too-distant future, space will establish itself as part of our social infrastructure,” says NAKAMURA Yuya, co-founder, president and CEO of Axelspace, a startup that provides innovative solutions through the use of microsattellites. The company’s vision is “Space Within Your Reach.” He continues, “The current position of the space industry is similar to that of the IT industry a few decades ago. It is expanding from governmental use to the private sector, with startups rapidly developing new services. Space is no longer a ‘special place’ but is increasingly a ‘place within our reach.’”

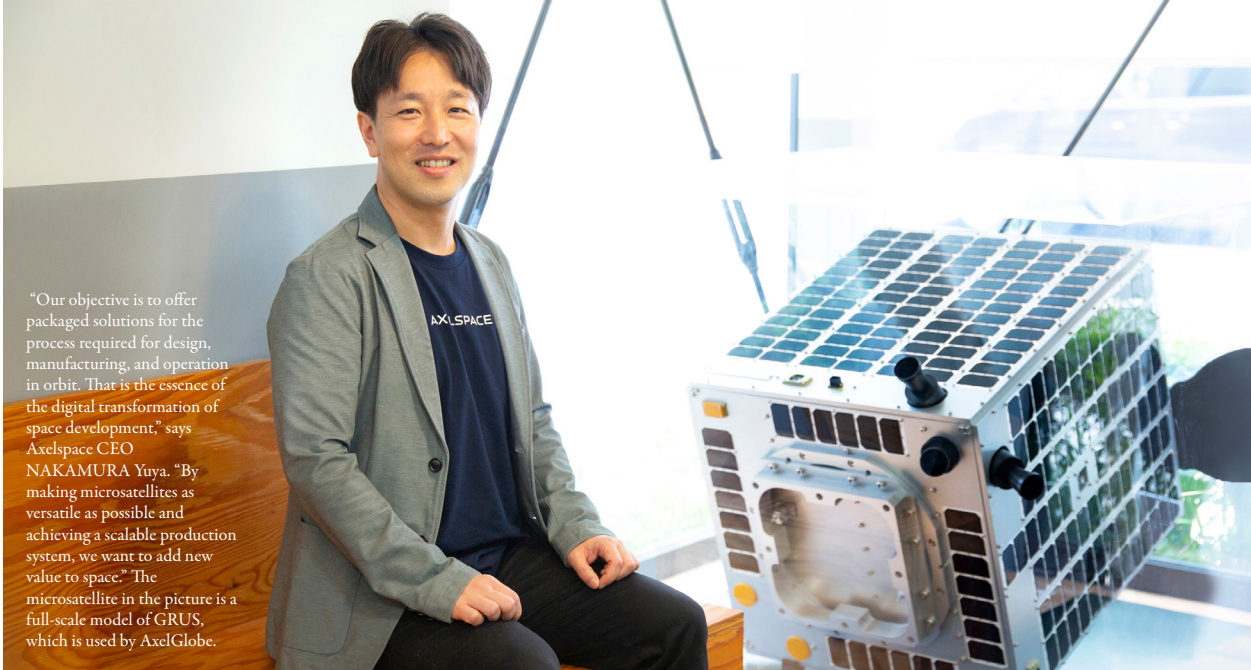
Nakamura was an engineering student at the University of Tokyo when he participated in a project to develop a CubeSat, a tiny satellite measuring 10 x 10 x 10 cm, which was successfully launched and operated in 2003—the first time ever in the world for such a small satellite. When he shared the images taken by the CubeSat with the world, the reaction was beyond his expectations, and he came to realize the potential of the space business, which he knew would have an immense impact on society. This experience led him to start his own business in 2008.

Axelspace offers two major business solutions. The first is AxelGlobe, an Earth-observation platform that shares satellite imagery of the planet obtained by GRUS—a next-generation remote-sensing microsattellite developed by the company—with which it provides data-analysis solutions. AxelGlobe has devised an integrated constellation of five GRUS satellites in which multiple satellites are linked and work in tandem as a single system to provide the company with frequent images of any point on the globe—with great ease and at low cost—to meet the various needs of its clients. Unlike full-size satellites that weigh up to a few tons, 100-kg-class microsattellites, such as GRUS, cannot convey the huge telescopes necessary to capture high resolution images. Instead, a constellation of smaller lower-cost satellites makes higher-frequency Earth monitoring possible, creating novel value that cannot be achieved by a single large satellite.

In the United States and elsewhere, for example, photographing large tracts of farmland requires multiple drones and much time, but one image taken from space can achieve the same result. “Microsattellites enable us to



Axelspace has developed an Earth-observation platform that utilizes a constellation composed of multiple microsattellites called GRUS. The platform is useful in many processes, such as predicting agricultural yields and assessing damage in disaster areas. Clients include banks looking to consider harvest predictions before providing loans. Above is an illustration of GRUS, of which five are currently in operation in orbit. AXELSPACE



“Our objective is to offer packaged solutions for the process required for design, manufacturing, and operation in orbit. That is the essence of the digital transformation of space development,” says Axelspace CEO NAKAMURA Yuya. “By making microsatellites as versatile as possible and achieving a scalable production system, we want to add new value to space.” The microsatellite in the picture is a full-scale model of GRUS, which is used by AxelGlobe.

provide data offering new value to space itself,” asserts Nakamura. “In agriculture, precision farming becomes possible by accessing daily crop health data, allowing areas where growth is slow to be assessed and fertilized accordingly. In some cases, banks have utilized our service because it enables them to predict crop yields before authorizing loans.”

Meanwhile, Axelspace’s other business, AxelLiner—announced in 2022—is a service that provides the complex procedures necessary for a satellite project all in one package. It is a unique one-stop service that encompasses all the segments of a space business, from design to production and operation. By developing mass-produced, highly versatile satellite buses, which are core bodies of satellites that are equipped with basic functions, Axelspace intends to provide its service in a more affordable and faster package, thus lowering the hurdles that prospective satellite users may face. In early 2024, AxelLiner plans to launch Pyxis, its first demonstration satellite.

Axelspace has also invested in further efforts to develop next-generation technology and participates in the

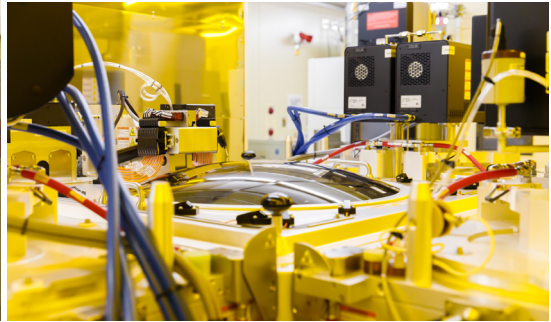
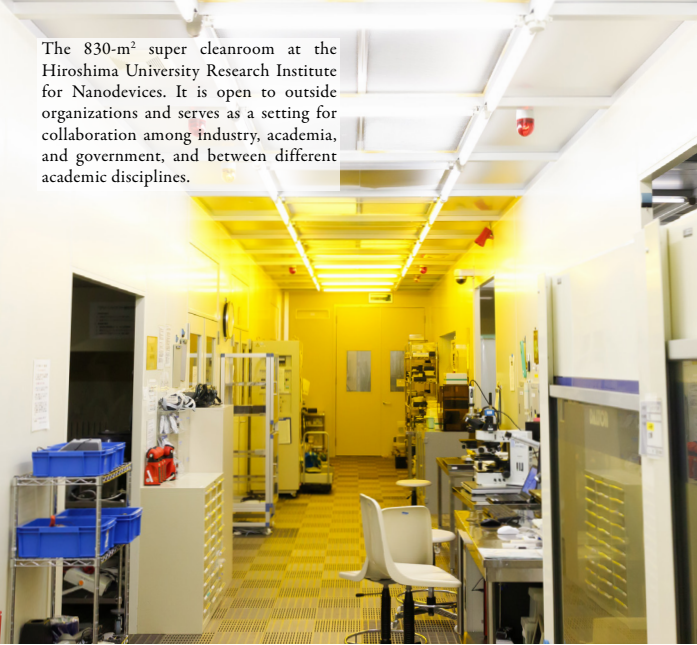
“development and demonstration of inter-satellite optical communication network system” program sponsored by Japan’s New Energy and Industrial Technology Development Organization (NEDO). If the optical communication network is set up between multiple satellites, not only will they facilitate a large-volume and low-delay data relay between space and the ground but the network can also be utilized as a backup communication system in times of severe disasters. By 2029, the company, together with its partners, plans to demonstrate the functionality and performance of the satellite optical communication network in the vicinity of Japan.

The motivation behind Nakamura’s pursuits is his passion for building microsatellites that are useful to society and for turning space into a common place with Earth observation and communication infrastructure usable by anyone and everyone. “I think that space should play a supporting role in that scenario. The way to create fresh solutions is by switching the focus from space to the people who use it,” he says. Nakamura will keep his foot on the accelerator until space is truly “within our reach.” ●



Establishing a constellation of small Earth-observation satellites can increase imaging frequency. Also, the medium-resolution GRUS, with an imaging range of 57 km, can capture a broad area at one time. The images above are of a jungle fire in Columbia (left), and a part of the U.S., showing plants’ distribution area and growing condition (right). AXELSPACE

The 830-m² super cleanroom at the Hiroshima University Research Institute for Nanodevices. It is open to outside organizations and serves as a setting for collaboration among industry, academia, and government, and between different academic disciplines.



JAPAN-U.S. PARTNERSHIP TO FOSTER DIVERSE TALENT FOR THE SEMICONDUCTOR INDUSTRY

With society undergoing rapid digitalization, semiconductors are a key technology that is essential to the realization of digitalization and decarbonization, as well as a crucial strategic material in light of economic security. Japan and the United States have joined forces to cultivate a more robust and highly skilled workforce in this field.

Semiconductors are integrated into many objects, from familiar electronic devices such as the smartphones and PCs we use in our daily lives to such basic social infrastructure as railroads and bank ATMs. Some say these materials, which process information for data storage, numerical calculations, and logical operations, are among the world's most critical resources in an age when all sorts of industries and products have been digitalized and vast amounts of data are exchanged over the Internet

on a daily basis. Even so, only a limited number of companies in the world can manufacture these components, thus it is urgent to decentralize semiconductor production bases and strengthen the capacity for their supply. Moreover, as digitalization spreads and grows ever more sophisticated, they must be technologically innovated to have even greater capacity, speed, miniaturization, reliability, and power efficiency.

That is why the U.S.-Japan University Partnership for



TERAMOTO Akinobu, Director and Professor of the Research Institute for Nanodevices at Hiroshima University, conducts research on structural design, manufacturing processes, and evaluation techniques for semiconductor devices. After working for Mitsubishi Electric Corporation as an engineer for a decade, he was a professor at the New Industry Creation Hatchery Center at Tohoku University before assuming his current position.

Workforce Advancement and Research & Development in Semiconductors (UPWARDS) for the Future was established in May 2023. With more than 60 million dollars in contributions expected over the next five years from a variety of sources including semiconductor companies, the partnership will deepen ties between industry and higher education across Japan and the U.S. Aimed at cultivating a more robust and highly skilled workforce through the development of leading semiconductor curricula and the creation of opportunities for cross-collaboration, the partnership will drive emerging research.

Japan's Hiroshima University is one of 11 institutes of higher education involved in UPWARDS for the Future. With a campus in Hiroshima Prefecture, the site of this year's G7 summit, it has one of the longest histories of semiconductor research in Japan. TERAMOTO Akinobu, Director of the Research Institute for Nanodevices at the university, said, "I think the partnership holds great significance because it allows us to build a network as a system, rather than relying



The facade of the Hiroshima University Research Institute for Nanodevices. Formerly named the Research Center for Integrated Systems, it was established in 1986.

solely on individual researchers' personal connections. Through exchanges with various universities and companies, we hope to nurture a workforce with a high level of expertise as well as broad perspectives that allow them to see the big picture in the semiconductor industry."

AOTO Nahomi, who used to work for Hiroshima-based Micron Memory Japan, K.K., a subsidiary of U.S. semiconductor manufacturer Micron Technology, Inc., is a specially appointed professor at the university. She said enthusiastically, "Without semiconductors, we cannot build our world's future. No other industry is growing like this one. There is a common misconception that Japan's semiconductor industry has declined, but in fact, sales of the product have held steady, and Japan still boasts advanced technological capabilities pertaining to semiconductor memory. We want to inform more people about the opportunities presented by semiconductors and attract more talent to support the industry. That is our primary goal with UPWARDS for the Future."

Providing opportunities for female students, staff and leaders, in particular, is another important objective of the partnership. Hiroshima University has already been offering scholarships and other support to women, but the partnership will further expand upon that. The purpose of focusing on support for women is not simply to recruit more excellent talent. Aoto said, "I feel that



AOTO Nahomi is a professor (special designation) at the Research Institute for Nanodevices at Hiroshima University. In the four decades since she was hired by NEC Corporation in 1983, she has been engaged in semiconductor-process research and development. During that time, the company was reorganized into Elpida Memory, Inc., and later became Micron Memory Japan, K.K. In 2023, she was appointed to her position at Hiroshima University.

semiconductor manufacturing is an industry in which employees are fairly evaluated and enjoy equal opportunities regardless of their gender. I want to tell as many people as possible that this is a place where women can demonstrate their abilities and flourish." She added, "From my own experience at Micron, where people from diverse backgrounds work, I am absolutely certain that both technology and society benefit when people from different backgrounds share their ideas and opinions."

Semiconductors are bound to become increasingly important for society's development and economic security. To create a more prosperous and stable world, universities and companies in both Japan and the U.S. will work closely together under UPWARDS for the Future to train a diverse semiconductor workforce and strengthen the industry's technology base. ●



The Mumbai-Ahmedabad High Speed Railway Corridor, which is currently under construction. Once its operation begins, the line is expected to have wide-ranging impacts, from improved convenience to a reduction in greenhouse gas emissions and revitalization of the surrounding area.
NHSRCL

THE MUMBAI-AHMEDABAD BULLET TRAIN: THE FIRST STEP TOWARD A SAFE, SUSTAINABLE SOCIETY

Under the G7 Partnership for Global Infrastructure and Investment, the Mumbai-Ahmedabad High Speed Railway Corridor project is moving forward in India. Adopting Japan's Shinkansen bullet train technology, the project aims to be as successful a model as the Delhi Metro, which brought multiple changes to society and industry.

Japan's railways are renowned for their high level of safety and precise technological capabilities, as well as their punctual operations. A prominent example is the Shinkansen bullet train. Countries around the world have likewise introduced high-speed rail systems in recent years, aiming to upgrade the convenience of their transportation networks. One of them, India, is adopting Japan's bullet train system for the first time for its Mumbai-Ahmedabad High Speed Railway Corridor (MAHSR), a 508-km-

long, high-speed rail line that will link the western metropolises of Mumbai and Ahmedabad.

Using rolling stock based on the Shinkansen's E5 series, which boasts speeds of up to 320 km/h, the new train will sharply reduce travel time between the two cities, from the current six hours to just two hours. Air travel, which is now the preferred method for completing the route, is projected to see more than 60% of its customers shift to the new bullet train, with the flexibility to get on and off en route and easy access to

other transportation.

MAHSR is one of the projects promoted under the Partnership for Global Infrastructure and Investment (PGII), a shared G7 commitment launched in 2022 to advance public and private investments in sustainable, inclusive, resilient and quality infrastructure. Through partnership with governments, the private sector, and financial institutions, the G7 aims to mobilize up to 600 billion dollars by 2027, in order to narrow the infrastructure investment gap in partner

countries. Japan is also delivering infrastructure investment around the world to mobilize more than 65 billion dollars in infrastructure assistance and private capital over the same period.

The process of building a huge piece of infrastructure in a country that differs in culture and mindsets is a herculean task. However, Japan's forte in the MAHSR project is its rich experience promoting subway construction projects across India for more than two decades. Notably, the track record and expertise gained through construction of the Delhi Metro, Japan's first project in India, form a strong foundation.

A good example is safety awareness at construction sites, which was low in India at the time. Japanese construction contractors, consultants, and Japan International Cooperation Agency (JICA) staff worked together



Left: ABE Reiko, Corporate Officer of Oriental Consultants Global and Chairperson of Oriental Consultants India, worked in tunnel construction in places such as Norway and Taiwan. Since 2007, she has worked as a consultant on subway construction projects in New Delhi, the capital of India, among other cities. Right: Abe (left) making the rounds of the Delhi Metro with a local staff member at the time of its construction. The project focused on local human resource development in anticipation of post-opening operation. "Our mission is to see the local staff become self-sufficient. Our work will only be done when they tell us they no longer need a consultant," said Abe. ORIENTAL CONSULTANTS GLOBAL

to distribute helmets and other personal protective equipment (PPE) to around 40,000 Delhi Metro construction workers, but these went unworn at first. To combat this, with the cooperation of the Delhi Metro Rail Corporation, a special regulation was enacted to prevent entry to construction sites without PPE.

That resulted in a big, positive impact, and also led to the practice being adopted by other subway projects. "It is crucial to take measures that consider a country's unique environment and culture," said ABE Reiko, Corporate Officer of Oriental Consultants Global Co., Ltd., who was involved in the Delhi Metro project and whose company is also one of the firms consulting on the MAHSR.

Over 20 years since launching in 2002, the Delhi Metro is now one of the largest subway systems in the world, with a daily average of more than 5 million passengers. And, with some of the local staff

who were involved in its launch now transferring their knowhow to other subway projects, the metro has led to a boost in the overall level of civil engineering in the country. For the MAHSR project, domestic firms mainly handle the phase of civil construction work, rather than relying on foreign companies.

"One day," recounted Abe, "when I was traveling in an auto rickshaw, we got stuck in traffic due to subway construction. The driver then told me with pride, 'Madam, this is our Metro! Great, isn't it?' I have never been so happy. His words inspire and motivate me even now." Just like the Delhi Metro, the MAHSR bullet train project has the potential to bring great change and growth to the country as a whole. "Eventually, our aspiration is to spur the development of a domestically self-supporting system. We will try our best so that one day, Indian people will say, 'Madam, this is our bullet train!'" ●



Due to serious security problems within India's public transportation system, baggage screening similar to that at an airport is conducted at the entrance to each station of the Delhi Metro (top), and security guards are positioned on the platforms. What is more, the introduction of women-only carriages (bottom) has led to an increase in the number of women working at companies located near to subway stations, having a significant impact on the overall employment rate. GETTY IMAGES



The Bortnychi Sewage Treatment Plant (bottom), which Nippon Koei had been helping to modernize (the work has been suspended due to the conflict), and the signing of the contract with the private joint stock company Kyivvodokanal to renovate the facility (left). MIURA Yoshitomo, General Manager of the Ukraine Recovery Office and in charge of this project, is second from the right in the left photo. NIPPON KOEI CO., LTD.



LEVERAGING JAPAN'S DISASTER EXPERIENCE FOR UKRAINE'S RECONSTRUCTION

Russia's aggression against Ukraine wages on. One company technologically capable of assisting Ukraine in the rebuilding of its infrastructure is Nippon Koei Co., Ltd., a comprehensive engineering consultancy firm from Japan. People from the firm spoke about its involvement in Ukraine and the country's reconstruction.

Ukraine is suffering badly as Russia persists with its aggression. Reaffirming Japan's support for Ukraine, Prime Minister Kishida stated that Japan will help Ukraine rebuild through public-private partnership. By utilizing its expertise in earthquake reconstruction and its extensive industrial and technological base, Japan intends to assist with the clearing of land mines and the rebuilding of Ukraine's infrastructure.

One Japanese company with a long history of cooperating on engineering projects in the infrastructure field is the comprehensive engineering

consultancy firm Nippon Koei Co., Ltd., which has expanded its business overseas to assist developing nations and war-torn countries. Through official development assistance (ODA) and private-sector projects, Nippon Koei has been involved in infrastructure development projects in 160 countries and regions.

Even before Russia's aggression against Ukraine began, Nippon Koei was working with the country on various aid projects, which included modernizing airports and building bridges. The most recent of those projects were the Bortnychi Sewage Treatment Plant

modernization project in Kyiv and the Capacity Development for Municipal Waste Management project in the three cities of Kyiv, Kharkiv and Dnipro, both commissioned by the Japan International Cooperation Agency (JICA). Though the sewage plant project had to be temporarily halted due to Russia's aggression, the waste management project continued until the end of the last fiscal year with a new objective of disposing of the debris called "destruction waste" in Ukraine that has resulted from the conflict. The proficiency Nippon Koei gained from its experience in dealing with the

recovery from the Great Hanshin-Awaji Earthquake in 1995 and the Great East Japan Earthquake in 2011 can also be applied to the disposal of the large volume of waste resulting from Russia's aggression. A series of online seminars was held in both 2022 and 2023 in collaboration with Japan's Ministry of the Environment, local government agencies, and private organizations that have knowledge of Japan's disaster waste management to share information with people in Ukraine on how to separate and recycle concrete, reinforcing bars, and other material from waste, as well as ways to make the process of waste treatment more efficient by estimating the amount of said waste.

Since Russia began its aggression against Ukraine, Nippon Koei has participated in several reconstruction projects in the war-torn country under contract either with JICA or the Ministry of Economy, Trade and Industry. The company established its Ukraine Recovery Office in April this year and opened a new representative

office in Warsaw, the capital of Poland, to be better placed to promote future projects and support ongoing projects.

General Manager of the Ukraine Recovery Office MIURA Yoshitomo said, "The war and the aging of equipment have necessitated a review of Ukraine's entire infrastructure. In creating a master plan for the country's reconstruction, we have received many requests from local people wanting to benefit from Japan's experience and knowledge. In addition, the number of engineers in Ukraine has declined as they have either been killed in the conflict or have fled the country. That is why we plan to help train new engineers." General Manager of the Warsaw Office, NAKAMURA Masahiro, added, "We want to contribute to the country's recovery and reconstruction by leveraging our strengths in a wide range of business fields and our far-reaching network."

But Nippon Koei's goal is not just reconstruction of war zones.



JICA invited Ukrainian officials to Japan in May 2023 to learn about the appropriate treatment and recycling of debris resulting from the conflict and visit a waste incineration plant. Left: DAIIEI KANKYO CO., LTD. / Bottom: NIPPON KOEI CO., LTD.



Ukraine's President Volodymyr Zelenskyy during the G7 Hiroshima Summit in May 2023. In addition to attending a summit meeting with Prime Minister Kishida, he laid a floral tribute at the Cenotaph for the Atomic Bomb Victims and offered a moment of silence. Zelenskyy said that he dreams of rebuilding all of Ukraine's cities just as Hiroshima was rebuilt.

"We will continue to support Ukraine so that it can develop its legal system and strengthen its national resilience towards its goal of joining the EU," declares Senior Specialist SOEDA Shungo, who oversees the waste management project. He goes on to say, "The people of Ukraine are truly kind and polite. Even in the early days of the aggression, they expressed their concern for the disasters Japan has suffered. I would love to collaborate with them to rebuild their country."

Going forward, Japan will work to further involve the private sector. As the Minister for Foreign Affairs of Japan, HAYASHI Yoshimasa, said on June 21, 2023 at the Ukraine Recovery Conference, co-hosted by the governments of the United Kingdom and Ukraine, "Japan intends to make use of its experience and knowledge it has accumulated in the field of recovery and reconstruction, and to vigorously implement a uniquely Japanese form of reconstruction assistance in close contact with the Ukrainian people." ●

This year's G7 Summit was held in Hiroshima, where the world's first nuclear weapon was used. The leaders visited the Peace Memorial Museum and left their names and messages in the visitors' book, then visited Peace Memorial Park to lay wreaths at the Cenotaph for the Atomic Bomb Victims.



JAPAN'S LONG EFFORTS TO REALIZE A WORLD WITHOUT NUCLEAR WEAPONS

As the only country to have suffered from atomic bombings during war, Japan has played a leading role in the international community's efforts towards nuclear disarmament and non-proliferation. At this time, when the world security environment is unstable, Japan has the responsibility to lead the international efforts for nuclear disarmament and continue to take concrete measures to realize a world without nuclear weapons.

For 78 years since the first nuclear weapon was used, the world has sustained the record of the non-use of nuclear weapons. Now, however, that history is more precarious than ever. Surrounded by China, a nuclear-weapon State, North Korea, persisting in its nuclear development, and Russia, threatening to use nuclear weapons in the invasion of Ukraine, East Asia's security environment is becoming particularly severe.

As the only country to have ever suffered atomic bombing during wartime, Japan has actively been leading international efforts for nuclear disarmament and non-proliferation. It has leveraged both multilateral frameworks and bilateral diplomatic opportunities based on the two-pronged recognition of the need for national security and the inhumane nature of nuclear weapons.

In August last year, Prime Minister KISHIDA Fumio became the first prime minister to attend the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)

Review Conference held in New York. The NPT is an international framework on nuclear non-proliferation with 191 countries and territories including both nuclear- and non-nuclear-weapon States. In his general debate speech, Prime Minister Kishida said that, as the guardian of the NPT, Japan would firmly defend it and that he would work on the "Hiroshima Action Plan" as the first step of a realistic road map to link the "reality" of a harsh security environment to the ideal of a world without nuclear weapons. As part of the plan, he also pointed out that Japan would promote the sharing of the accurate understanding of the realities of nuclear weapon use in the world by encouraging visits to the atomic-bombed cities, namely Hiroshima and Nagasaki, by leaders and others from various countries.

True to his words, in May, the prime minister hosted the G7 Summit in Hiroshima, where the world's first atomic bomb was dropped. The leaders of the G7 and invited

Right: Prime Minister Kishida delivered a speech at the Hiroshima Peace Memorial Ceremony on August 6, stating that “The starting point for making firm progress towards the realization of a ‘world without nuclear weapons’ is accurately understanding the tragic realities of the atomic bombings.”



Top: The First Preparatory Committee for the 2026 NPT Review Conference opened in July 2023 in Vienna. “There has not been a time since the depths of the Cold War that the risk of a nuclear weapon being used has been so high...The NPT has earned its status as the so-called ‘cornerstone of the disarmament and non-proliferation regime’ because it is key to maintaining the hard-won norms against nuclear weapons,” said NAKAMITSU Izumi, UN Under-Secretary-General and High Representative for Disarmament Affairs. [JUI](#)

Left: Professor AKIYAMA Nobumasa also attended the First Preparatory Committee for the 2026 NPT Review Conference held in Vienna. “It is imperative to reduce the risk of using nuclear weapons and to build mutual trust between nations. In the coming years, when emerging technologies such as AI in nuclear deterrence and arms control will become major issues, Japan should be firmly involved in the rulemaking exercises in those fields,” he said. [THE MAINICHI NEWSPAPERS](#)



countries and heads of international organizations visited the Hiroshima Peace Memorial Museum, which shows the devastation caused by the bombing, and listened to the voice of an atomic bombing survivor. The G7 leaders issued the “G7 Leaders’ Hiroshima Vision on Nuclear Disarmament,” the first-ever G7 Leaders’ document with a particular focus on nuclear disarmament.

“The fact that the Japanese government hosted the G7 meeting in Hiroshima and put forward a vision for nuclear disarmament even amidst a difficult strategic environment, demonstrates to the world Japan’s consistent commitment through actions, not just words,” said Professor AKIYAMA Nobumasa, Dean of Hitotsubashi University’s School of International and Public Policy. “Never before have so many heads of state and government, including President Volodymyr Zelenskyy of Ukraine, and leaders of invited countries, come together to be exposed to the realities of the atomic bombings. By visiting Hiroshima and learning the (catastrophic and inhumane) impact, they reaffirmed the norm of standing against the use of nuclear weapons. Japan’s role as a bridge between nuclear- and non-nuclear-weapon States, and the continuation of the history of non-use, will serve as an important foundation for rendering nuclear weapons unnecessary.”

Another effort by Japan was the International Group of Eminent Persons for a World Without Nuclear Weapons (IGEP) launched in 2022 under the initiative of Prime Minister Kishida. The purpose of the IGEP is to serve as an opportunity for 15 experts from nuclear- and non-

nuclear-weapon States to engage in candid discussions beyond their respective national positions.

Following the second meeting of the IGEP in April this year, with the sense of urgency that the current crisis must be turned into an opportunity to strengthen the nuclear non-proliferation regime, particularly by maintaining and strengthening the NPT, the IGEP issued a message to the Review Conference of the Parties to the NPT. Professor Akiyama is also a member of the IGEP and said, “The challenges for the future involve how to create a mechanism to reduce nuclear risks, including avoidance of inadvertent escalation and how to improve the NPT Review Process to enable substantive discussions on issues related to nuclear disarmament, such as transparency.”

The widening division within the international community over approaches to nuclear disarmament, Russia’s nuclear threat, and other concerns now make the road to a world without nuclear weapons all the more difficult. In his address at the 78th Hiroshima Peace Memorial Ceremony, Prime Minister Kishida emphasized, “it is precisely because of these circumstances that it is imperative for us to reinvigorate international momentum once more towards the realization of a world without nuclear weapons.”

Japan will continue to lead candid dialogue between nuclear- and non-nuclear-weapon States at various fora, including those of the United Nations (UN) and the NPT, and will continue its tireless efforts towards nuclear disarmament in cooperation with the international community. ●

SENSING JAPANESE AUTUMN

AMID THE COLORED LEAVES

With its plethora of red, yellow, and orange trees, Japan becomes vibrantly dyed in the autumn. To feel the glow of colors that seem to warm the chilly air, visit Japan in this beautiful season.

AUTUMN IN THE WATER MIRROR

Chuson-ji temple in Hiraizumi Town, Iwate Prefecture, was inscribed in 2011 on the UNESCO World Heritage List. After the temple was founded in the mid-9th century, large-scale construction was carried out with a prayer for a peaceful world free of strife. Although the gorgeously decorated golden hall is particularly famous, the small structure situated in the middle of the pond stands out in the fall as a treat for the eyes. Its silhouette framed by the red maples reflected on the mirror-like water surface can only be viewed at this time of year. AFLO



ON THE PILGRIMAGE ROUTE

Shikoku Island contains a pilgrimage route of about 1,400 km that follows the footsteps of a Buddhist monk active some 12 centuries ago, linking 88 temples where he practiced spiritual austerities. Today, many international visitors can be seen among the pilgrims wearing white garments and conical hats as they make the tour. The act of setting off on a journey of self-encounter, rambling through four prefectures on the island rich in regional distinctiveness and blessed with autumn colors, is instinctively appealing. A.F.L.O.



QUINTESSENTIAL JAPANESE LANDSCAPE



The beauty of autumn foliage in Japan is attributed to the country's wealth of deciduous broad-leaf tree species. Seasonal color changes in the mountains and trees render the Japanese landscape predictably fascinating. A small hamlet in Shirakawa Village, Gifu Prefecture, is famous for its rows of thatched-roofed houses, most of whose residents still conduct their daily lives there. This is Shirakawa-go, another World Heritage Site. When planning a visit to the valley—a veritable living landscape showing Japan as it used to be—make sure to go there in the radiant fall season. A.F.L.O.

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